PATENT ABSTRACTS OF JAPAN

(11)Publication number : 09-284200

(43)Date of publication of application : 31.10.1997

(51)Int.Cl. H04B 7/26
H01Q 3/26
H04Q 7/36
H04Q 7/38

(21)Application number : 08-088417

(22)Date of filing : 10.04.1996

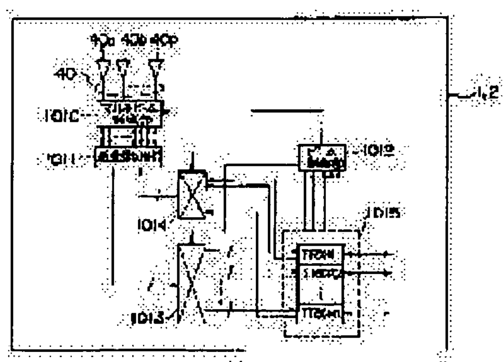
(71)Applicant : MITSUBISHI ELECTRIC CORP

(72)Inventor : SHIBUYA AKIHIRO
MORIYA YOICHI
FUKUI NORIYUKI
KAWABATA TAKASHI

(54) RADIO COMMUNICATION EQUIPMENT AND RADIO COMMUNICATION METHOD

(57)Abstract:

PROBLEM TO BE SOLVED: To obtain the radio communication equipment and its method in which same frequency interference power is reduced and the system capacity is improved by allowing a base station to selectively control the transmission of an omnidirectional beam or a narrow beam based on radio terminal information received from a radio terminal equipment.



SOLUTION: Each of base stations 1, 2 uses a beam control section 1012 to select/control transmission of an omnidirectional beam or a narrow beam based on radio terminal information of an opposite party such as same frequency channel interference, mobile speed and in-cell traffic according to an arrived radio wave received by a plurality of antenna elements 40a-40p of an antenna array 40 prior to the transmission and uses a desired beam so as to conduct communication. Thus, Each advantage of the omnidirectional beam and the narrow beam is utilized for beam assignment, and the same frequency interference power is reduced more than the conventional communication method with the omnidirectional beam only and the radio communication equipment and the method whose system capacity is improved are obtained.

LEGAL STATUS

[Date of request for examination]	29.01.2003
[Date of sending the examiner's decision of rejection]	
[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]	
[Date of final disposal for application]	
[Patent number]	
[Date of registration]	
[Number of appeal against examiner's decision of rejection]	
[Date of requesting appeal against examiner's decision of rejection]	
[Date of extinction of right]	

* NOTICES *

Japan Patent Office is not responsible for any damages caused by the use of this translation.

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the cel block diagram showing the gestalt 1 of operation of this invention.
[Drawing 2] It is the block diagram having shown the configuration of the base station by the gestalt 1 of operation of this invention.
[Drawing 3] It is the explanatory view of the multi-beam formation by the gestalt 1 of operation of this invention of operation.
[Drawing 4] It is the cel block diagram showing the gestalt 2 of operation of this invention.
[Drawing 5] It is the block diagram having shown the configuration of the wireless terminal by the gestalt 2 of operation of this invention.
[Drawing 6] It is the flow chart having shown actuation of the beam control section by the gestalt 3 of operation of this invention.
[Drawing 7] It is the flow chart having shown actuation of the beam control section by the gestalt 4 of operation of this invention.
[Drawing 8] It is the flow chart having shown actuation of the beam control section by the gestalt 5 of operation of this invention.
[Drawing 9] It is the flow chart having shown actuation of the beam control section by the gestalt 6 of operation of this invention.
[Drawing 10] It is the flow chart having shown actuation of the beam control section by the gestalt 7 of operation of this invention.
[Drawing 11] It is the block diagram having shown the configuration of the base station by the gestalt 8 of operation of this invention.
[Drawing 12] It is the block diagram having shown the configuration of the wireless terminal by the gestalt 9 of operation of this invention.
[Drawing 13] It is the cel block diagram showing the channel change in a cel by the gestalt 10 of operation of this invention.
[Drawing 14] It is the flow chart having shown channel change actuation of the gestalt 10 of operation of this invention.
[Drawing 15] It is the cel block diagram showing the channel change between cels by the gestalt 11 of operation of this invention.
[Drawing 16] It is the flow chart having shown the channel change between cels of the gestalt 11 of operation of this invention.
[Drawing 17] It is the flow chart having shown channel change actuation of the gestalt 12 of operation of this invention.
[Drawing 18] It is drawing having shown the graph of a cel radius (m) and relation with the maximum transmitted power (mW).
[Drawing 19] It is the conventional base station cel block diagram by two or more narrow beams.
[Description of Notations]
1, 2, 3, 4 A base station, 1x, 2x, 3x Omni beam (** area zone), 2a-2s 40 A base station narrow beam, 60

An antenna array, 40a-40p, 60a-60p Antenna element, 80 90 It is a beam control section, and 1010 and 1310 during a communication link. Multi-beam formation section, 1011 1311 The transceiver change section, a 1012 beam control section, 1013 A reception switch matrix, 1014 A transmitting switch matrix, 1015 A transmitter-receiver unit, 1012 A beam control section, 1312 transmitter-receivers.

[Translation done.]

* NOTICES *

Japan Patent Office is not responsible for any damages caused by the use of this translation.

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1] With the radio communication equipment which consists of a base station which performs radio mutually, and a wireless terminal A receiving means for the above-mentioned base station to receive the signal from the above-mentioned wireless terminal, The beam control means for carrying out the selection control of whether it transmits with the Omni beam and which beam of a narrow beam based on the other party information based on the signal received with the above-mentioned receiving means, The radio communication equipment characterized by having a transmitting means for transmitting with the beam chosen by the above-mentioned beam control means.
[Claim 2] A terminal side receiving means for the above-mentioned wireless terminal to receive the signal from the above-mentioned base station, The terminal side beam control means for carrying out the selection control of whether it transmits with the Omni beam and which beam of a narrow beam based on the other party information based on the signal received with the above-mentioned terminal side receiving means, The radio communication equipment according to claim 1 characterized by having a terminal side transmitting means for transmitting with the beam chosen by the above-mentioned beam control means.
[Claim 3] The level test section to which the above-mentioned other party information is the sending-signal level of the above-mentioned wireless terminal, and the above-mentioned beam control means measures the sending-signal level of the above-mentioned wireless terminal, By the comparison result of the level comparator for comparing with a predetermined threshold the above-mentioned sending-signal level measured by the above-mentioned level test section, and the above-mentioned comparator The radio communication equipment according to claim 1 or 2 characterized by having the first beam allocation processing section for performing either the Omni beam allocation processing and narrow beam allocation processing.
[Claim 4] Migration/quiescence detection section for detecting whether the above-mentioned other party information is the terminal attribute whether the above-mentioned wireless terminals are whether it is a migration terminal and a quiescence terminal, and they are whether the above-mentioned beam control means is [the above-mentioned wireless terminal] a migration terminal and a quiescence terminal, The radio communication equipment according to claim 1 or 2 characterized by having the second beam allocation processing section for performing either the Omni beam allocation processing and narrow beam allocation processing by the detection result of the above-mentioned migration/quiescence detection section.
[Claim 5] A passing speed detecting element for the above-mentioned other party information to be the passing speed of the above-mentioned wireless terminal, and for the above-mentioned beam control means detect the passing speed of the above-mentioned wireless terminal, By the comparison result of the rate comparator for measuring with a predetermined threshold the passing speed detected by the above-mentioned passing speed detecting element, and the above-mentioned rate comparator The radio communication equipment according to claim 1 or 2 characterized by having the third beam allocation processing section for performing either the Omni beam allocation processing and narrow beam

allocation processing.
[Claim 6] A traffic volume detecting element for the above-mentioned other party information to be the traffic volume of the above-mentioned wireless terminal, and for the above-mentioned beam control means detect the traffic volume of the above-mentioned wireless terminal, By the comparison result of the traffic volume comparator for measuring with a predetermined threshold the traffic volume detected by the above-mentioned traffic volume detecting element, and the above-mentioned traffic volume comparator The radio communication equipment according to claim 1 or 2 characterized by having the fourth beam allocation processing section for performing either the Omni beam allocation processing and narrow beam allocation processing.
[Claim 7] A demand quality level detection means by which the above-mentioned other party information is the demand quality level of the above-mentioned wireless terminal, and the above-mentioned beam control means detects the demand quality level of the above-mentioned wireless terminal, The radio communication equipment according to claim 1 or 2 characterized by having the fifth beam allocation processing section for performing either the Omni beam allocation processing and narrow beam allocation processing based on the demand quality level detected by the above-mentioned demand quality level detection means.
[Claim 8] The radio communication equipment according to claim 1 to 7 characterized by having a beam control means further during a communication link for the above-mentioned base station carrying out the selection control of whether it transmits with the Omni beam and which beam of a narrow beam based on the other party information from which it may change under communication link based on the signal received with the above-mentioned receiving means.
[Claim 9] The radio communication equipment according to claim 1 to 8 characterized by having a beam control means further during a terminal side communication link for the above-mentioned wireless terminal carrying out the selection control of whether it transmits with the Omni beam and which beam of a narrow beam based on the other party information from which it may change under communication link based on the signal received with the above-mentioned terminal side receiving means.
[Claim 10] The channel change section in a cel for a beam control means to judge whether the channel change in a cel is performed during a communication link during the above-mentioned communication link, Judge it to be the change place beam number selection section for choosing the optimal change place beam number whether a beam current in use is a narrow beam, and when it is a narrow beam The narrow beam change section for changing it to the narrow beam of the beam number chosen by the above-mentioned change place beam number selection section, The same frequency crossing judging section for judging whether the same frequency crossing occurs, The radio communication equipment according to claim 1 to 9 characterized by having the frequency change section which performs the change of a frequency when the same frequency crossing occurs based on the judgment result of the same above-mentioned frequency crossing judging section.
[Claim 11] The radio communication equipment according to claim 10 characterized by having further the change place base station selection section for a beam control means choosing the optimal change place base station during the above-mentioned communication link.
[Claim 12] The radio communication equipment according to claim 11 characterized by equipping a beam control means with the interference prediction section for predicting the interference in a change cel from the passing speed of the electric-wave arrival direction from the other party, and the other party further during the above-mentioned communication link.
[Claim 13] The radio approach characterized by to have the process as which the above-mentioned base station chooses whether it transmits with the Omni beam and which beam of a narrow beam by receiving the signal from the above-mentioned wireless terminal based on the other party information based on this signal by the radio approach for performing radio between a base station and a wireless terminal, and the process to which the above-mentioned base station transmits with the beam by which selection was made [above-mentioned].
[Claim 14] The radio approach according to claim 13 characterized by having the process to which the above-mentioned wireless terminal carries out the selection control of whether it transmits with the

Omni beam and which beam of a narrow beam by receiving the signal from the above-mentioned base station based on the other party information based on this signal, and the process to which the above-mentioned wireless terminal transmits with the beam by which selection was made [above-mentioned].

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] It is related with a radio communication equipment and the radio approach for especially this invention to perform high-speed mobile communication and broadband data communication in a cellular radio method about a radio communication equipment and the radio approach.
[0002]
[Description of the Prior Art] Generally in cellular mobile communication, raising frequency use effectiveness by aiming at reuse of a geographical frequency is performed by using it in the wireless zone distant beyond fixed distance repeatedly. The zone (it is called a cel) reused is geographically arranged so that the same frequency crossing may become below a permissible level. When a land-mobile propagation property sets distance of a base station and a wireless terminal to R (m), propagation-loss L (R) in free space is shown by the bottom type (the foundation of mobile communication: edited by Institute of Electronics, Information and Communication Engineers). L(R) =10 log2 (4pi d/lambda) If (1), when a carrier frequency will be set to 60GHz, L (R) is L(R) =68+20 log (R). It is set to (2). That is, cellular mobile communication reuses the channel which has an electric-wave damping property as shown by (2) formulas under permission interference level. For this reason, if it is going to realize high speed wireless access by cellular mobile communication, the examination about the problem of the (a) maximum transmitted power and the problem of (b) same frequency channel interference reduction will become important.
[0003] Explanation is added about the problem of (a). Generally as for the wireless circuit design in cellular mobile communication, that Okumura and Shinshi are indicated to be to ** "the foundation of mobile communication" (Institute of Electronics, Information and Communication Engineers issue) is known widely. According to it, transmitted power defines the rate (Outage) of location degradation in a cel, and is decided to make the value below into default value. The rate of location degradation is defined by the rate of a location which is less than necessary C/(N+I) (the wave level pair noise level of choice, and interference wave level) within a cel. Short section median fluctuation and antenna gain are chosen appropriately, and the result of having found transmitted power is shown in drawing 18 . Drawing 18 shows the following things.
(i) If there is about 80mW transmitted power (p-p) in the radius of 20m when it is going to realize transmission of 10Mbps class at 5% of rates of location degradation, it is possible enough.
(ii) When it is going to realize transmission of 100Mbps class at 5% of rates of location degradation, 800mW transmitted power (p-p) is needed in the radius of 20m.
That is, when it is going to realize high speed wireless access based on the conventional technique, it turns out that there is no approach besides permitting very big transmitted power or making a cel radius small.
[0004] On the other hand, when it is going to realize data transmission and wireless packet transmission by cellular mobile communication, especially cautions are required for the problem of (b). When

performing data transmission, as compared with voice data, it is because higher circuit quality is required. For example, although it is required from voice data transmission in the PHS system by which current utilization is carried out that an error rate should be less than [10E-3], data transmission requires an error rate still lower than it. That is, if transmitted power is fixed, in cellular mobile communication, it will mean that a larger desired-to-undesired signal power ratio must be taken, and that will become the factor which checks the improvement in frequency use effectiveness. In addition, when performing high-speed-data transmission, since the problem of the selective fading by the multiple scattering wave appears notably, reservation of necessary circuit quality becomes difficult.
[0005] In order to conquer such a technical problem, there is a cellular radio method using a directional antenna. There are the features referred to as that it can reduce transmitted power since it is known that a delay spread can be made small and a directional antenna can take large antenna gain. As a method which applies a directional antenna, there is an array beam method which forms a sector-ized method and a multiplex beam. Although sector-ization is an effective means to employ the features of a directional antenna efficiently, it is to 60-degree beam width that sector-ization functions effectively, and the expected effectiveness is not acquired any more. As one of the reasons, since the channel change in a cel is needed when a wireless terminal moves between sectors, since a sector cel is treated as a separated cel, it is mentioned that a channel change overhead increases.
[0006] The special feature at the time of applying an array beam is shown in JP,7-79476,A in detail, for example. According to this, the thing possessing two or more antenna arrays which have the capacity which forms the separate duplicate narrow beam, respectively is indicated by the azimuth, and if an array beam is applied, the trouble of sector-izing is cancelable. The configuration of the conventional base station cel indicated by JP,7-79476,A is shown in drawing 19 .
[0007] Drawing 19 shows the conventional example at the time of constituting a base station antenna from two or more narrow beams. For 1 and 2, as for the ** area area of base stations 1 and 2, and 1p, 1a, 1b, 1c, 2h, 2i, 2j and 2k, in drawing, a base station, and 1x and 2x are [a narrow beam and 11] wireless terminals, respectively. drawing 19 -- the ** area of a base station 1 -- area 1x -- passing -- the ** area of a base station 2 -- the appearance of the wireless terminal 11 included in area 2x is shown. The narrow beam change algorithm of a base station 1 supervises the wireless terminal 11 which passes narrow beams 1p, 1a, 1b, and 1c, and predicts that the wireless terminal 11 moved to the narrow beams 2k, 2j, 2i, and 2h of the base station 2 of a cel 2. The base station cel constituted with two or more narrow beam antennas becomes possible [treating not as the cel separated when considered from a network viewpoint but as indirectional cel arrangement]. That is, the wireless terminal 11 does not generate the channel change accompanying migration fundamentally by beam change. This is the decisive difference between a multi-beam cel and a sector-ized cel. Therefore, since sector change traffic does not occur, sharp reduction of the load of the channel change traffic occupied to network total traffic will be attained, and a degree of freedom will be given to the antenna control approach more than before.
[0008] The method which constitutes a cel is effective in reducing the interference signal which comes from the dispersion signal and the wireless terminal of the same frequency use which are produced with geographical feature or a building in an uphill channel (wireless terminal 11 -> base stations 1 or 2) by constituting a base station antenna from two or more narrow beams. Furthermore, since a problem like the channel change between sectors does not arise compared with a sector-ized cel and overhead traffic decreases, it can be said that use of a narrow beam antenna is a very effective means which raises frequency use effectiveness.
[0009]
[Problem(s) to be Solved by the Invention] However, when concrete cel arrangement is considered, there are the following troubles.
(a) When it will go up if the antenna of the wireless terminal 11 is used as the Omni beam, and there is no interference reduction effectiveness of a channel (wireless terminal 11 -> base stations 1 or 2), it gets down and multiple wave delay of a circuit poses a problem. (b) High density traffic exists, and if a narrow beam is applied to all the wireless terminals 11 under message in an environment in which application of the minimum cel is considered, when the wireless terminal 11 will move, the load which

beam tracking takes, and the change control traffic according to the increment in beam change frequency further cannot be disregarded. (c) Generally, in the minimum cel, since the wave of choice is received in a prospect in many cases, instantaneous-value fluctuation (multi-pass phasing) of the signal strength by the multiple echo is small, and the sufficiently high wave level of choice can be secured. When the wireless terminal 11 is in a semi- quiescent state in such a case, since space correlation will become large if a narrow beam is used, the space diver city effectiveness decreases.

[0010] That is, although narrow beam-ization has reduction of the same frequency interference noise, and the effectiveness which makes a delay spread small, since interference noise does not become [traffic density] a problem as compared with the stowage of a system in the minimum cel in being small, it poses a main problem that the space diver city effectiveness decreases because space correlation becomes large by the effectiveness of narrow-beam-izing.

[0011] Furthermore, during a communication link, to perform the channel change in a cel for the same frequency crossing evasion, it is necessary to change a frequency or a slot with the Omni beam, but, and since these changes serve as a new source of interference to a change place channel use user, if they do not perform suitable channel allocation, when it thinks by the whole system, they will induce an unnecessary channel change and have a problem.

[0012] It is also the same as when the channel change between cels needs to be performed during a communication link with the Omni beam. Although it is necessary to change a frequency or a slot, these changes serve as a new source of interference to a change place channel use user.

[0013] Moreover, when performing the channel change between cels in a cel, it is necessary to determine a change place base station (for there to be also a case of the same base station), a new frequency, etc. as suitable at the time of a change, and an instant. When a beam change is required, the optional feature of the optimal beam is further needed, and the load at the time of a channel change increases.

[0014] Moreover, while a narrow beam has a multi-pass and the effectiveness of reducing the same frequency crossing, by narrowing an angle of incidence, since space correlation becomes large, when a received wave has a wireless terminal in a quiescent state in the location which is in a fade condition geographically, it has the trouble of being hard to acquire the space diver city effectiveness.

[0015] As explained above, when it is going to apply the Omni beam and a narrow beam to cellular system, it turns out that merits and demerits are in each. This invention is made in order to solve this trouble, and it aims at obtaining the radio communication equipment in which the beam allocation which can employ each advantage of the Omni beam and a narrow beam efficiently is possible, and a radio method.

[0016]

[Means for Solving the Problem] The radio communication equipment concerning this invention is a radio communication equipment which consists of a base station which performs radio mutually, and a wireless terminal. A beam control means for a base station to carry out the selection control of whether it transmits with the Omni beam and which beam of a narrow beam based on the other party information based on the signal received with the receiving means and receiving means for receiving the signal from a wireless terminal, It has the transmitting means for transmitting with the beam chosen by the beam control means.

[0017] Moreover, the wireless terminal is equipped with the terminal side beam control means for carrying out the selection control of whether it transmits with the Omni beam and which beam of a narrow beam based on the other party information based on the signal received with the terminal side receiving means for receiving the signal from a base station, and the terminal side receiving means, and the terminal side transmitting means for transmitting with the beam chosen by the beam control means.

[0018] Moreover, the other party information is the sending-signal level of a wireless terminal, and the beam control means is equipped with the first beam allocation processing section for performing either the Omni beam allocation processing and narrow beam allocation processing by the comparison result of the level test section which measures the sending-signal level of a wireless terminal, the level comparator for comparing with a predetermined threshold the sending-signal level measured by the level

test section, and a comparator.
[0019] Moreover, the other party information is the terminal attribute whether wireless terminals are whether it is a migration terminal, and a quiescence terminal, and it has the second beam allocation processing section for carrying out in either the Omni beam allocation processing and narrow beam allocation processing by the detection result of migration/quiescence detection section for a beam control means to detect whether a wireless terminal is a migration terminal or it is a quiescence terminal and migration/quiescence detection section.
[0020] Moreover, the other party information is the passing speed of a wireless terminal, and the beam control means is equipped with the third beam allocation processing section for performing either the Omni beam allocation processing and narrow beam allocation processing by the comparison result of the passing speed detecting element for detecting the passing speed of a wireless terminal, the rate comparator for measuring with a predetermined threshold the passing speed detected by the passing speed detecting element, and a rate comparator.
[0021] Moreover, the other party information is the traffic volume of a wireless terminal, and the beam control means is equipped with the fourth beam allocation processing section for performing either the Omni beam allocation processing and narrow beam allocation processing by the comparison result of the traffic volume detecting element for detecting the traffic volume of a wireless terminal, the traffic volume comparator for measuring with a predetermined threshold the traffic volume detected by the traffic volume detecting element, and a traffic volume comparator.
[0022] Moreover, the other party information is the demand quality level of a wireless terminal, and the beam control means is equipped with the fifth beam allocation processing section for performing either the Omni beam allocation processing and narrow beam allocation processing based on the demand quality level detected by demand quality level detection means to detect the demand quality level of a wireless terminal, and the demand quality level detection means.
[0023] The base station is further equipped with the beam control means based on the other party information from which it may change under communication link based on the signal received with the receiving means during the communication link for carrying out the selection control of whether it transmits with the Omni beam and which beam of a narrow beam.
[0024] Moreover, the wireless terminal is further equipped with the beam control means based on the other party information from which it may change under communication link based on the signal received with the terminal side receiving means during the terminal side communication link for carrying out the selection control of whether it transmits with the Omni beam and which beam of a narrow beam.
[0025] Moreover, the channel change section in a cel for a beam control means to judge whether the channel change in a cel is performed during a communication link during a communication link, Judge it to be the change place beam number selection section for choosing the optimal change place beam number whether a beam current in use is a narrow beam, and when it is a narrow beam The narrow beam change section for changing it to the narrow beam of the beam number chosen by the change place beam number selection section, It has the same frequency crossing judging section for judging whether the same frequency crossing occurs, and the frequency change section which performs the change of a frequency when the same frequency crossing occurs based on the judgment result of the same frequency crossing judging section.
[0026] Moreover, the beam control means is further equipped with the change place base station selection section for choosing the optimal change place base station during the communication link.
[0027] Moreover, the beam control means is further equipped with the interference prediction section for predicting the interference in a change cel from the passing speed of the electric-wave arrival direction from the other party, and the other party during the communication link.
[0028] The radio approach concerning this invention is the radio approach for performing radio between a base station and a wireless terminal, and the base station received the signal from a wireless terminal, and it has the process which chooses whether it transmits with the Omni beam and which beam of a narrow beam, and the process to which a base station transmits with the selected beam based on the

other party information based on this signal.

[0029] Moreover, the wireless terminal received the signal from a base station, and it has the process which carries out the selection control of whether it transmits with the Omni beam and which beam of a narrow beam, and the process to which a wireless terminal transmits with the selected beam based on the other party information based on this signal.

[0030]

[Embodiment of the Invention]

The gestalt of operation of this invention is explained with reference to a drawing below gestalt 1. of operation. Drawing 1 (a) is drawing having shown the base station cel configuration in the radio communication equipment of this invention. Drawing 1 (b) is the partial enlarged drawing having shown one of the base station cels by the narrow beam in the cel configuration of drawing 1 (a). For a base station and 1x, in drawing 1 , the Omni beam of a base station 1, and 2a-2p of the narrow beam of a base station 2, and 11 and 12 are [1 and 2 / a wireless terminal and 3x] the Omni beams of the wireless terminal 11. Hereafter, actuation is explained based on drawing 1 . Drawing 1 shows the example in the case of having arranged base stations 1 and 2 on the basis of the so-called 6 angle cel. About 6 angle cel arrangement, Okumura and Shinshi are indicated in detail by ** "the foundation of mobile communication" (Institute of Electronics, Information and Communication Engineers issue), for example. However, this invention is not restricted to 6 angle cel, and, in other cases, can be applied. In drawing 1 , a base station 1 is the Omni beam, a base station 2 is a narrow beam (multi-beam), and signs that it is transmitting, respectively are shown. In drawing 1 , the multi-beam shall consist of 16 narrow beams. Although the separate sign shows the base station 1 and the base station 2, they are the same configuration fundamentally, and the optimal antenna pattern is chosen, transmitted on account of explanation and received among the wireless terminals 11 and 12. Namely, if all the base stations 1 and 2 may perform narrow beam transmission, may perform transmission by the Omni beam conversely and say further, Omni differs from a narrow beam for every [every channel the wireless terminal 11, or] 12. The wireless terminal 11 transmits and receives between base stations 2, when it is the base station and drawing 1 (b) from which a receive state serves as best. To the wireless terminal 11, a base station 2 transmits by narrow beam 2a, and transmits the wireless terminal 3 by Omni beam 3x. On the other hand, the wireless terminal 12 is transmitted and received by Omni beam 1x between the ** area base stations 1 concerned. That is, the wireless terminals 11 and 12 communicate by receiving the sending signal of the base stations 1 and 2 transmitted by either the Omni beam or the narrow beam. Base stations 1 and 2 choose and control in any it shall transmit between the Omni beam / narrow beam in advance of transmission with the wireless terminal 11. Control is performed based on the information on the wireless terminals 11 or 12 of the other party, such as the same frequency channel interference, passing speed, and traffic in a cel. These information differs for every [the wireless terminal 11 or] 12, for example, makes disconnection etc. a performance index during the amount of the same frequency crossings, channel change frequency, and a message, and it controls it so that those evaluation values become the optimal.

[0031] The configuration of the base stations 1 and 2 which choose and control the Omni beam / narrow beam, and are transmitted is shown in drawing 2 . In drawing 2 , 40 is an antenna array and has two or more antenna elements 40a-40p which transmit and receive a signal to a wireless terminal. The multi-beam formation section for 1010 to form two or more antenna patterns based on a signal to transmit from the signal received in antenna elements 40a-40p or base stations 1 or 2 and 1011 are the transceiver change sections for changing the timing of a transceiver signal. 1012 is a beam control section for performing control to which the Omni pattern is assigned to the wireless terminals 11 or 12 being accessed by the Omni pattern while controlling the multi-beam formation section 1010 so that a suitable antenna pattern is formed to each of the wireless terminals 11 or 12 under communication link in the base stations 1 or 2 concerned. 1013 is a reception switch matrix for connecting to the transmitter-receiver unit 1015 the signal outputted from the transceiver change section 1014, and 1014 is a transmitting switch matrix for matching with a narrow beam signal the signal which should be transmitted to the wireless terminals 11 or 12 from the transmitter-receiver unit 1015. 1015 is a

transmitter-receiver unit which processes the signal transmitted and received. It supposes that drawing 2 shows only the minimum component required for explanation of this invention, and the below-mentioned explanation of operation is briefly described since the technique of multi-beam formation is not the essence of this invention, and detailed explanation is omitted here. About the concrete implementation approach which forms a multi-beam, "copy trust digital beamforming antenna:Karasawa and Inomata" who were carried by the September issue in the electronic informatics meeting magazine Heisei 7 fiscal year, for example have a detailed publication.

[0032] Hereafter, actuation of drawing 2 is explained. Actuation of base station reception is explained to the beginning. The wireless terminal 11 performs transmission to the ** area cel base station 2 by Omni beam 3x. In a base station 2, the signal transmitted from the wireless terminal 11 is brought to the multi-beam formation section 1010, after receiving by two or more antenna element 40x (being here x=a-p) of an antenna array 40. If the case where multi-beam formation is performed by digital beamforming (DBF) is taken for an example, the multi-beam formation section 1010 will make two or more antenna patterns by changing an input signal into a digital signal at each antenna element 40x of every, and giving and compounding a wait which is different in every antenna element 40x. This situation is shown in drawing 3 . Among drawing 3 , PB1-PBn are the mimetic diagrams of an antenna pattern, and B1-Bn are the transceiver signals (it shall use properly hereafter in the direction of a narrow beam sending signal, a narrow beam input signal, and a call signal) corresponding to an antenna pattern PBx (x=1-n). Moreover, about the Omni pattern, you shall generate in the multi-beam formation section 1010, and the antenna for the Omni patterns shall be formed separately. An input signal turns into an input signal equivalent to having been received by antenna element 40x with a narrow beam property as shown in PB1-PBn by signal processing in the multi-beam formation section 1010. Although a base station 2 receives two or more user signals to coincidence, this generates two or more narrow beam patterns to coincidence in the multi-beam formation section 1010, and it is realized with outputting as output signals B1-Bn. It has the function which changes the timing of a transceiver signal, for example, can realize as a switch which changes transmission and reception in time by TDD (Time Division Duplex), i.e., the system which performs transmission and reception by turns in time on the same frequency, and the transceiver change section 1011 is realized by the duplexer by FDD (Frequency Division Duplex), i.e., a different frequency, in the system which needs simultaneous transmission and reception. Moreover, the reception switch matrix 1013 connects an output signal Bx to specific transmitter-receiver TRX#x (x= 1, 2, ..., n) of the transmitter-receiver unit 1015.

[0033] Next, actuation of base station transmission is explained. The sending signal from the transmitter-receiver unit 1015 is matched with the narrow beam sending signal Bx by the transmitting switch matrix 1014. The narrow beam sending signal Bx corresponds to the antenna pattern PBx formed in the multi-beam formation section 1010, and the sending signal of each specific transmitter-receiver TRX#x is transmitted by the desired antenna pattern PBx towards the communication link place wireless terminals 11 or 12 by changing the transmitting switch matrix 1014 appropriately. In addition, at this time, the beam control section 1012 performs control to which the Omni pattern is assigned to the wireless terminals 11 or 12 to be accessed by the Omni pattern while controlling the multi-beam formation section 1010 so that the suitable antenna pattern PBx is formed to each of the wireless terminals 11 or 12 under communication link in the base station concerned. Furthermore, the multi-beam formation section 1010 performs relating with each specific transmitter-receiver TRX#x of the transmitter-receiver unit 1015, and the antenna pattern PBx containing the Omni pattern to the reception switch matrix 1013 and the transmitting switch matrix 1014.

[0034] In the radio communication equipment and the radio approach concerning this invention A base station is based on the arrival electric wave received by antenna elements 40a-40p in advance of transmission. In the beam control section 1012, selection and control of in any it shall transmit between the Omni beam / narrow beam are done based on the information on the wireless terminals 11 or 12 of the other party, such as the same frequency channel interference, passing speed, and traffic in a cel. Since it was made to communicate using the more desirable one of the Omni beam / the narrow beams, the same frequency crossing power can be reduced from the correspondence procedure constituted only

from a conventional Omni beam, and it is effective in raising system capacity.
[0035] The gestalt 2 of gestalt 2. implementation of operation is explained using drawing 4 . It sets to drawing and they are 3a-3e (hereafter referred to as 3i collectively.). i=a-e is the narrow beam of wireless terminal 11A. Since other components are the same as drawing 1 , the same sign shows and the explanation is omitted here. As shown in drawing 4 (b), a base station 2 transmits by narrow beam 2a to wireless terminal 11A. On the other hand, between base stations 2, wireless terminal 11A chooses the optimal transmitting pass, and transmits as narrow beam 3i of wireless terminal 11A. The configuration of wireless terminal 11A is shown in drawing 5 . In drawing 5 , 60 is an antenna array and has two or more antenna elements 60a-60p which transmit and receive a signal to a base station 2. 1310 is the multi-beam formation section and has the same function as the multi-beam formation section 1010 of drawing 2 . 1311 is the transceiver change section, 1312 is a beam control section, and these have the respectively same function as the transceiver change section 1011 of drawing 2 , and the beam control section 1012. 1313 is a transmitter-receiver which processes a transceiver signal. In drawing 5 , a transmitter-receiver 1313 will be one set, and if this point is removed, drawing 5 will be the almost same configuration as drawing 2 . Moreover, in wireless terminal 11A, since a transmitting beam does not need to be a multi-beam, it becomes unnecessary [the transmitting switch matrix 1014]. Since similarly it is not necessary to switch the signal which the receiving system also received with two or more multi-beams to specific transmitter-receiver TRX#x (to refer to drawing 2) from which plurality differs, the reception switch matrix 1013 is also unnecessary. The beam control section 1312 is controlled to create one or more narrow beam antenna patterns which make interference power min while making control for generating the optimal transmitting narrow beam pattern while choosing and controlling in any it shall transmit between the Omni beam / narrow beam, and received power into max.
[0036] A wireless terminal is based on the arrival electric wave received by antenna elements 60a-60p in advance of transmission like the base station of the gestalt 1 of operation. In the beam control section 1312, selection and control of in any it shall transmit between the Omni beam / narrow beam are done based on the information on the base station of the other party, such as the same frequency channel interference, passing speed, and traffic in a cel. Since it was made to communicate using the more desirable one of the Omni beam / the narrow beams, it is effective in reducing the same frequency crossing power further and raising system capacity more from the method constituted only from a conventional Omni beam.
[0037] Gestalt 3. of operation, next base stations 1 and 2 explain the beam allocation approach in the case of starting wireless terminal 11A and a message. Beam allocation is performed by the beam control sections 1012 and 1312 prepared in base stations 1 and 2 and wireless terminal 11A. Drawing 6 is the flow chart having shown actuation of beam allocation. In drawing 6 , the procedure of the beam allocation in base stations 1 and 2 is shown, and only the element required to explain actuation of this invention is extracted. In drawing, the step to which step S30 supervises a received electric-field level measurement step, and step S31 supervises call origination, the step which compares received electric-field level measured value to the received electric-field level threshold to which step S32 was set beforehand, the step to which step S33 carries out allocation processing of the Omni beam to a call, and step S34 are steps which carry out allocation processing of the narrow beam.
[0038] This level is received, when a base station 2 measures beforehand the sending-signal level (RSSImes) of wireless terminal 11A (step S30) and call origination occurs (step S31). The level comparison with the threshold (RSSIth) established beforehand is performed (step S32), and it is a threshold RSSIth. If it becomes above, allocation processing of the Omni beam will be performed (step S33), and it is a threshold RSSIth. If it becomes below, allocation processing of a narrow beam will be performed (step S34). The probability for the Omni beam (1x reference of drawing 1) to be assigned by this to wireless terminal 11A which exists in 1 or about 2 base station becomes high, and, on the other hand, a narrow beam (refer to 2a of drawing 1 - 2p) comes to be assigned to wireless terminal 11A which exists in a base station 1 and two distant places.
[0039] In addition, when the element of migration is in wireless terminal 11A, a narrow beam will be strongly influenced of the elevation angle of an antenna element, and an azimuth in 1 or about 2 base

station, and the frequency of a beam change and a beam monitor increases. On the other hand, since 1 or about 2 base station has little propagation loss and effect of a multi-pass, its need for a narrow beam is not high. On the other hand, a propagation loss, a multi-pass, and since it is further influenced strongly of the same frequency crossing, the communication link by the narrow beam is desirable at a base station 1 and the two distant places. The frequency of a beam change and a beam monitor may also be [/ near the cel] low. Allocation control of a frequency, a slot, etc. is performed in the Omni beam allocation processing (step S33). In addition to a frequency and a slot, a narrow beam number is assigned in narrow beam allocation processing (step S34). A narrow beam number is a number which shows any of a base station narrow beam (2 x:x=a-p) they are, and chooses the optimal narrow beam by supervising received field strength and the same frequency crossing power. In addition, if the procedure of drawing 6 is applied also to wireless terminal 11A by wireless terminal 11A when narrow beam formation is possible, the channel stabilized further is securable.
[0040] as mentioned above, the threshold which a base station, a wireless terminal, or its both have the function which supervises received electric-field level in the gestalt of this operation, and was set up about received electric-field level -- ** -- since it compares and was made to perform allocation control of the Omni beam / narrow beam, it is effective in reducing the beam change frequency of the wireless terminal near the base station, and reducing the interference power of the wireless terminal of the cel circumference
[0041] gestalt 4. of operation -- the approach of other beam allocations is explained in the gestalt of this operation. Drawing 7 is the flow chart having shown the procedure of the beam allocation in the base stations 1 and 2 by the gestalt of this operation, and only the element required to explain actuation of this invention is extracted. S41 is a step the attribute beforehand registered into the call origination wireless terminal judges a quiescence terminal or a migration terminal to be, and other steps are the same as that of drawing 6 . When a base station 2 has the call origination from a wireless terminal, wireless terminal 11A is supervised (step S31), and if the wireless terminal 11A is the wireless terminal which carried out the call request, it will investigate the attribute of the wireless terminal 11A (step S41). The attribute of a wireless terminal here is included in the information exchanged between base stations 1 and 2 and wireless terminal 11A at the time of call origination, and shows whether wireless terminal 11A is a migration terminal and whether it is a quiescence (immobilization) terminal. In the case of a quiescence (immobilization) terminal, the attribute of wireless terminal 11A performs the Omni beam allocation (step S33), and, in the case of a migration terminal, performs narrow beam allocation (step S34). The Omni beam is assigned by this to stationary wireless terminal 11A, and, on the other hand, a narrow beam comes to be assigned to wireless terminal 11A which moves. That is, since there is little effect of multi-pass fluctuation, wireless terminal 11A in a quiescent state performs reception with the Omni beam, and when wireless terminal 11A is installed in the point where level has fallen even in extent which is especially a quiescent state and poses a problem, it improves a property by space diver cities, such as for example, antenna change DAIBASHICHI. Reservation of the received electric-field level by the space diver city cannot be expected when a narrow beam is used. It is because space correlation of a received wave cannot be taken, so it is necessary to take sufficient-room-distance in a narrow beam. That is, if a quiescence wireless terminal uses a narrow beam, in order to operate a space diver city, the distance between antennas must be taken and it is not effective. Since the effect of the high-speed multi-pass fluctuation generated with migration by assigning a narrow beam to a mobile radio terminal on the other hand and short section median fluctuation can be reduced and the amount of the same frequency crossings can be reduced, it becomes possible to mitigate sharply necessary [CIR] (wave power pair interference wave power ratio of choice), and a CIR margin. In addition, beam allocation shown in drawing 7 may be performed by wireless terminal 11A. Namely, when a wireless terminal has a narrow beam formation function, according to the algorithm shown in drawing 4 , a wireless terminal side also performs Omni / narrow beam generation at the time of call origination.
[0042] As mentioned above, in the gestalt of this operation, it is effective in reducing the effect of multiple wave interference and raising system capacity at the time of call origination, when a migration terminal communicates, since the wireless terminal of the other party identifies whether it is a mobile

radio terminal or it is a quiescence wireless terminal and was made to perform the Omni beam / narrow beam allocation control by that cause.
[0043] Gestalt 5. drawing 8 of operation shows the procedure of other beam allocation in the base stations 1 and 2 by the gestalt of this operation, and only the element required to explain actuation of this invention is extracted. S51 is passing speed. Vmes The step to presume and S52 are presumed passing speed. Vmes Threshold of passing speed Vth It is the step to compare and other steps are the same as that of drawing 6 . A base station 2 presumes the passing speed of wireless terminal 11A, when call origination occurs (step S31) (step S51), and it is presumed passing speed Vth. Vmes Threshold Vth It compares (step S52) and is presumed passing speed. Vmes Threshold Vth If it is the following, the Omni beam allocation will be performed (step S33), and it is a threshold. If it is the following, narrow beam allocation will be performed (step S34). By this procedure, the Omni beam is assigned to a low-speed migration terminal, and a narrow beam comes to be assigned to a high-speed migration terminal. About the approach of passing speed presumption, that what is necessary is just to presume by carrying out [observe / for example, / the period to which receiving level falls according to a circuit condition], it cannot restrict in that case but various approaches can be used. As mentioned above, in the gestalt of this operation, the Omni beam or narrow beam allocation is performed by introducing a passing speed detection function (step S51) according to presumed passing speed. In addition, beam allocation shown in drawing 8 may be performed by wireless terminal 11A. Namely, when wireless terminal 11A has a narrow beam formation function, according to the algorithm shown in drawing 8 , the wireless terminal 11A side is also made to perform the Omni beam / narrow beam generation at the time of call origination.
[0044] As mentioned above, a base station, a wireless terminal, or both have the function to detect the passing speed of the other party wireless terminal in the gestalt of this operation, and since it was made to perform the Omni beam / narrow beam allocation control to the threshold set up about passing speed, it is effective in reducing the effect of multiple wave interference and raising system capacity also in the wireless terminal from which passing speed changes.
[0045] Gestalt 6. drawing 9 of operation shows other procedures of the beam allocation in base stations 1 and 2, and only the element required to explain actuation of this invention is extracted. S61 is the message traffic volume in a cel. Gmes The step to presume and S62 are presumed traffic volume. Gmes Traffic volume threshold Gth It is the step to compare and other steps are the same as that of drawing 6 . A base station 2 is message traffic volume Gth of a wireless terminal, when call origination occurs (step S31). Gmes It presumes (step S61) and is presumed message traffic volume. Gmes and threshold Gth It compares and is presumed message traffic volume. Gmes Threshold Gth If it is the following, the Omni beam allocation will be performed (step S33), and it is a threshold. If it is the following, narrow beam allocation will be performed (step S34). By this procedure, if message traffic becomes [the Omni beam] high when there is little message traffic in a cel, a narrow beam will come to be assigned. That is, at the time of low message traffic, if indispensable beam change control at the time of narrow beam use is made unnecessary by using the Omni beam antenna since the effect of the same frequency crossing etc. is not large and message traffic volume increases, in order to remove the effect of the interference noise which increases with geographical frequency reuse, a narrow beam is used.
[0046] As mentioned above, in the gestalt of this operation, a base station, a wireless terminal, or both have the traffic monitoring function which supervises the traffic volume in the cel concerned, and since it was made to perform the Omni beam / narrow beam allocation control to the threshold set up about the traffic volume in a cel, when there is little traffic in a cel, it is effective in reducing a beam change load.
[0047] Gestalt 7. drawing 10 of operation shows other procedures of the beam allocation in base stations 1 and 2, and only the element required to explain actuation of this invention is extracted. S71 is a step the attribute beforehand registered into the call origination wireless terminal judges a high quality demand wireless terminal or the wireless terminal which is not so to be, and other steps are the same as that of drawing 6 . If there is a call request, base stations 1 and 2 supervise a wireless terminal with a call request (step S31), and if it is a call origination terminal, the attribute of the wireless terminal 11A will

be investigated (step S71). The service request of that the attribute of a wireless terminal here is the wireless terminal which is included in the information exchanged between base stations 1 and 2 and wireless terminal 11A at the time of call origination, and makes a voice message the main purpose of use for whether wireless terminal 11A is high quality demand terminals, such as a data transmission dedicated terminal, etc. and wireless terminal 11A is given as a quality attribute. Consequently, when allocation is wireless terminal 11A as which the Omni beam requires (step S33) and high quality when the attribute of wireless terminal 11A is the wireless terminal which does not require high quality, narrow beam allocation is performed (step S34). That is, the communication link by the narrow beam by which, as for a high quality demand terminal, the effect and the same frequency crossing conditions of multi-pass fluctuation have been improved is performed, and the wireless terminal which is not high performs the communication link by the Omni beam without a beam change control load, and mitigates the control load of a wireless terminal.

[0048] How to determine according to real use circuit quality is easily considered besides the approach of linking to the service request for every [which mentioned above the quality demand level of wireless terminal 11A] terminal. For example, it is the method which performs beam allocation which performs narrow beam allocation according to a geographical problem when a receiving environment is inferior also at the wireless terminal only for voice messages. In this case, it becomes possible by defining the receiving circuit quality of current wireless terminal 11A as an attribute of wireless terminal 11A. Receiving circuit quality is easily realizable by using the average error rate at the time of a message, Presumption CIR, etc.

[0049] In the gestalt of this operation, since the quality demand level of the wireless terminal of the other party was made to perform the Omni beam / narrow beam allocation, it is effective in reducing a beam change load. In addition, beam allocation shown in drawing 10 may be performed by wireless terminal 11A. Namely, when wireless terminal 11A has a narrow beam formation function, according to the algorithm shown in drawing 10 , the wireless terminal 11A side also performs the Omni beam / narrow beam generation at the time of call origination.

[0050] The gestalt of operation of this invention is explained with reference to a drawing below gestalt 8. of operation. The configuration of the base stations 1A and 2A which choose and control the Omni beam / narrow beam, and are transmitted during a communication link is shown in drawing 11 . In drawing 11 , 80 is a beam control section during a communication link, since other components are the same as that of drawing 2 , the same sign shows and the explanation is omitted here. Next, actuation of a base station 1 and transmission of two is explained. During a communication link, the beam control section 80 controls so that the beam optimal during a message is formed to each of wireless terminal 11A under communication link in the base stations 1 and 2 concerned. The optimal link of base stations 1 and 2 and wireless terminal 11A is an incident by generating and disappearance of the same frequency crossing terminal at migration and the radio-wave-propagation property of wireless terminal 11A, and a pan. For this reason, during a communication link, by the beam control section 80, per channel, change of received-electric-field level, the same frequency crossing power, and passing speed etc. supervises circuit quality, and the Omni beam / narrow beam allocation control is performed according to conditions so that the always suitable antenna patterns PB1-PBn (refer to drawing 3) may be formed.

[0051] As mentioned above, since it chose and controlled by any a base station should communicate between the Omni beam / narrow beam during a message and waiting by having the beam control section 80 further during a communication link in the gestalt of this operation, they are the Omni beam / narrow beam also during a message. It can change, the same frequency crossing power is reduced further, and it is system capacity. It is effective in making it improve.

[0052] The gestalt 9 of gestalt 9. implementation of operation is explained using drawing 12 . In drawing 12 , 90 is a beam control section during a message. Drawing 12 is the same configuration as drawing 5 except for the point that the beam control section 90 was formed during the message. The beam control section 90 is controlled during a communication link to create one or more narrow beam antenna patterns which make max control (transmission control) for the transceiver channel concerned to generate the optimal transmitting narrow beam pattern and received power, and make the same

frequency crossing power min (reception control).
[0053] Since a wireless terminal performs the Omni beam / narrow beam change also during a message by having had the beam control section 90 during a message and the beam control section 1312 which awaits and performs selection and control of a change with a narrow beam and the Omni beam to inside, and a communication link, it is effective in reducing the same frequency crossing power further and raising system capacity more.
[0054] The channel change procedure in a cel at the time of using the gestalt 10. narrow beam of operation is explained using drawing 13 . In drawing 13 , 1, 2, and 3 are base stations, and 1x, 2x, and 3x are the ** area zones of base stations 1, 2, and 3, respectively. 1a-1s, 2a-2s, and 3a-3s are narrow beams which base stations 1, 2, and 3 form, and 11, 12, 13, and 14 are wireless terminals. The case where the wireless terminal 11 in ** area zone 1x of a base station 1 carries out a beam change now is made into an example, and it explains below. The wireless terminal 11 moves in other directions of narrow beam 1i from narrow beam 1b, and performs the channel change demand in a cel. Although the wireless terminal 13 in ** area zone 3x of the base station 3 which is using the same frequency for this time of day is communicating using 3l. of narrow beams, in order that the wireless terminal 11 may not receive the same frequency crossing with antenna directivity, a channel change is performed by beam change. On the other hand, although the channel change was required in order that the wireless terminal 12 in ** area zone 1x of a base station 1 might move to 1m of narrow beams from 1d of narrow beams Since the same frequency crossing will occur if a beam change is performed, since the wireless terminal 14 is communicating the same frequency by narrow beam 2p within ** area zone 2x of a base station 2 at this time of day, a frequency change and a beam change are performed to coincidence.
[0055] Although channel change control of these single strings is performed by the beam change 90 (refer to drawing 12) during the communication link in a base station during the beam change 80 (refer to drawing 11) or a communication link, drawing 14 explains the actuation. Drawing 14 is the flow chart having shown the procedure of the channel change in a cel, and only the element required to explain actuation of this invention is extracted. S201 is a step which supervises the channel change in a cel, S202 is a step which chooses a change place beam number, S203 is a step which supervises the same frequency crossing, S204 is a step which performs a frequency change, it is the step which judges any S205 shall use between a current narrow beam / Omni beam, and S206 is a step which changes the beam for a communication link to the narrow beam of a new number.
[0056] The channel change in a cel (step S201) will choose a change place beam number, if it is carried out by supervising the circuit quality information represented by received electric-field level and interference power and the channel change conditions in a cel are satisfied (step S202). Selection (step S202) of a change place beam number chooses the optimal narrow beam by the approach of scanning the beam from which received electric-field level serves as max, or a beam from which the wave power pair interference wave power ratio (CIR) of choice serves as max, changing a receiving beam, if the case where it chooses in base stations 1, 2, and 3 is taken for an example. The scan of the beam number which makes received electric-field level max must be performed to the wave of choice, and it is necessary to make it not detect the same frequency interference wave accidentally. A beacon signal may be established according to an individual for every base station, and you may make it receive the signal which built in the recognition signal aiming at pinpointing a sending station like a color code as this concrete example. In presuming circuit quality (step S203) and not fulfilling regular circuit quality by the same frequency crossing etc. after determining a change place beam number with the optimal level in step S202, it is judged as a thing with the same frequency crossing, and performs a frequency change (step S204). Furthermore, it judges whether it is under [narrow beam use] ******** (step S205), and in narrow beam being under use, it performs a beam change now (step S206). In addition, selection (step S202) of a change place beam number may be performed by wireless terminal 11 and 12 and 13 side.
[0057] About the channel change in a cel narrow beam in use, when there is no effect of the same frequency crossing by the electric-wave arrival direction detection function, it corresponds by beam change, and when influential, it is made to perform a frequency change (channel change). Consequently, in the beam change in a cel under communication link using a narrow beam, since a frequency change is

not performed when the same frequency crossing does not occur, it is effective in the ability to reduce the forced release under message.

[0058] The channel change procedure between cels at the time of using gestalt 11. of operation, next a narrow beam is explained using drawing 15 . In drawing 15 , 1, 2, 3, and 4 are base stations, 1x-4x are the ** area zones of base stations 1-4, 1a-1s, 2a-2s, 3a-3s, and 4a-4s are the narrow beams which base stations 1-4 form, respectively, and 110, 111, 112, and 113 are wireless terminals. The case where the wireless terminals 111 and 110 in a base station 1 carry out a beam change between cels now is explained to an example below. The wireless terminal 111 moves during a message by 1h of narrow beams within ** area cel 1x of a base station 1 in the direction of narrow beam 3p in ** area cel 3x of a base station 3, and is performing the channel change demand between cels. Although the wireless terminal 112 which is using the same frequency for this time of day is communicating within ** area cel 4x of a base station 4 using 4s of narrow beams, in order that the wireless terminal 111 may not receive the same frequency crossing with antenna directivity, the channel change between cels is performed by beam change. On the other hand, in order that the wireless terminal 110 might move during a communication link by 1k at 2g of narrow beams in ** area cel 2x of a base station 2, the channel change was required, but since the wireless terminal 113 is communicating the same frequency by narrow beam 4p in the base station 4 at this time of day, if a beam change is performed, the same frequency crossing will occur. Therefore, in this case, in order to avoid interference, a frequency change and a beam change are performed to coincidence.

[0059] Although channel change control of these single strings is performed by the beam change 90 during the beam change 80 or the communication link of a wireless terminal during the communication link of a base station, drawing 16 explains the actuation. Drawing 16 shows the channel change procedure in a cel, and only the element required to explain actuation of this invention is extracted. S301 is a step which supervises the channel change in a cel, S302 is a step which chooses a change place base station, S303 is a step which performs ****** of a change place beam number, and other components are the same as that of drawing 14 . The channel change between cels (step S301) is performed by supervising the circuit quality information which is a base station or a wireless terminal and is represented by received electric-field level and interference power, and if the channel change conditions between cels are satisfied, the base station concerned will choose a change place base station (step S302). Selection (step S302) of a change place base station serves as the same actuation as selection (step S202) of the change place beam number in drawing 14 . That is, the base station concerned requests retrieval of the optimal beam number to the base station which serves as a candidate of a change place. Changing a receiving beam, a change place candidate base station chooses the optimal narrow beam by the approach of scanning the beam from which received electric-field level serves as max, or a beam from which the wave power pair interference wave power ratio (CIR) of choice serves as max, and reports it to the base station concerned. The base station concerned which received the report chooses the base station where received electric-field level serves as max most out of a change place candidate as a change place base station. The scan of the beam number which makes received electric-field level max is realizable with the same means as drawing 14 .

[0060] It sets in the gestalt of this operation above like. A base station about the channel change in a cel, narrow beam in use When influential [when there is no effect of the same frequency crossing by the electric-wave-arrival direction detection function it corresponds by beam change, and], while being made to perform a frequency change (channel change) Since a frequency change will not be performed if the same frequency crossing level becomes below a threshold, since it was made to choose the change place base station, it is effective in the ability to reduce the forced release under message further.

[0061] gestalt 12. of operation -- in the gestalt of this operation, when performing the channel change between cels by the narrow beam, when a wireless terminal moves within a change place cel, channel allocation based on interference prediction which already avoided the frequency in use within the change place cel is performed as the approach of a frequency change in case the same frequency crossing arises with a change place beam. Although 2m of narrow beams is already using it in a base station 2 and the same frequency as this frequency is assigned to the wireless terminal 110 if drawing 15

is explained to an example, an unnecessary channel change is reduced by detecting the migration direction of the wireless terminal 110, and avoiding and assigning this frequency beforehand, when it is the direction that direction of whose is 2m of narrow beams. Drawing 17 explains the beam allocation procedure in this case. The interference prediction step S120 predicts interference within a cel to be, and S121 are steps a frequency change judges it to be whether it is the need as a result of interference prediction, and others are the same as that of drawing 16 . As a result of performing concrete actuation by interference prediction (step S120) of a channel change place base station and performing frequency allocation as a result of passing speed detection and the electric-wave arrival direction detection, the wireless terminals which originate in migration of a wireless terminal and use the same frequency approach, and when a side channel change may be started, the frequency allocation which avoided this is carried out. That is, though the interference level from another wireless terminal in use [the channel which it is going to assign] is below a threshold, when interference will be predicted in the future from the passing speed and the electric-wave arrival direction of the wireless terminal concerned and an interference wireless terminal, the unnecessary channel change in a cel is prevented by avoiding this frequency.

[0062] As mentioned above, in the gestalt of this operation, about the channel change between cels narrow beam in use, a change place base station performs the same frequency crossing power measurement from [of a wireless terminal] beam arrival, and if interference power is below the set-up threshold Since frequency allocation which avoided the frequency is performed when the same frequency is being used in a change place base station from migration, since it was made to give priority to a beam change over a channel change, it is effective in reducing channel change frequency.

[0063]

[Effect of the Invention] Since this invention is constituted as explained above, effectiveness which is indicated below is done so.

[0064] The radio communication equipment of this invention is a radio communication equipment which consists of a base station which performs radio mutually, and a wireless terminal. It is based on the other party information based on the signal which the above-mentioned base station received with the receiving means and receiving means for receiving the signal from a wireless terminal. Since it had the beam control means for carrying out the selection control of whether it transmits with the Omni beam and which beam of a narrow beam, and the transmitting means for transmitting with the beam chosen by the beam control means A base station can change and use the Omni beam and a narrow beam, the same frequency crossing power can be reduced compared with the case where it communicates only with the conventional Omni beam, and system capacity can be raised.

[0065] Moreover, a terminal side receiving means for a wireless terminal to receive the signal from a base station, The terminal side beam control means for carrying out the selection control of whether it transmits with the Omni beam and which beam of a narrow beam based on the other party information based on the signal received with the terminal side receiving means, Since it had the terminal side transmitting means for transmitting with the beam chosen by the beam control means It can be used being able to change the Omni beam and a narrow beam, the same frequency crossing power can be further reduced compared with the case where it communicates only with the conventional Omni beam, and a wireless terminal can also raise system capacity more.

[0066] Moreover, the level test section to which the other party information is the sending-signal level of the above-mentioned wireless terminal, and a beam control means measures the sending-signal level of a wireless terminal, By the comparison result of the level comparator for comparing with a predetermined threshold the sending-signal level measured by the level test section, and a comparator Since it had the first beam allocation processing section for performing either the Omni beam allocation processing and narrow beam allocation processing Since sending-signal level performs beam allocation processing by whether it is below a predetermined threshold, it is effective in reducing the beam change frequency of the wireless terminal near the base station, and reducing the interference power of the wireless terminal of the cel circumference.

[0067] Moreover, migration/quiescence detection section for detecting whether the other party

information is the terminal attribute whether wireless terminals are whether it is a migration terminal and a quiescence terminal, and they are whether a beam control means is [a wireless terminal] a migration terminal and a quiescence terminal, By the detection result of migration/quiescence detection section, it has the second beam allocation processing section for performing either the Omni beam allocation processing and narrow beam allocation processing. There are whether a wireless terminal's having which attribute of quiescence/migration and effectiveness of reducing the effect of multiple wave interference and raising system capacity when a migration terminal communicates, since it judges and the Omni beam / narrow beam allocation is performed.
[0068] Moreover, a passing speed detecting element for the other party information to be the passing speed of a wireless terminal, and for a beam control means detect the passing speed of a wireless terminal, By the comparison result of the rate comparator for measuring with a predetermined threshold the passing speed detected by the passing speed detecting element, and a rate comparator Since it has the third beam allocation processing section for performing either the Omni beam allocation processing and narrow beam allocation processing, the passing speed of a wireless terminal is detected and the Omni beam / narrow beam allocation is performed Also in the wireless terminal from which passing speed changes, it is effective in reducing the effect of multiple wave interference and raising system capacity.
[0069] Moreover, a traffic volume detecting element for the other party information to be the traffic volume of the above-mentioned wireless terminal, and for a beam control means detect the traffic volume of a wireless terminal, By the comparison result of the traffic volume comparator for measuring with a predetermined threshold the traffic volume detected by the traffic volume detecting element, and a traffic volume comparator Since it has the fourth beam allocation processing section for performing either the Omni beam allocation processing and narrow beam allocation processing, a base station supervises the traffic volume in a self-cel and the Omni beam / narrow beam allocation is performed When there is little traffic in a cel, it is effective in reducing a beam change load.
[0070] Moreover, a demand quality level detection means by which the other party information is the demand quality level of a wireless terminal, and a beam control means detects the demand quality level of a wireless terminal, It is based on the demand quality level detected by the demand quality level detection means. Since it has the fifth beam allocation processing section for performing either the Omni beam allocation processing and narrow beam allocation processing and the quality demand level of a wireless terminal performs the Omni beam / narrow beam allocation, it is effective in reducing a beam change load.
[0071] Moreover, a base station is based on the other party information from which it may change under communication link based on the signal received with the receiving means.

JAPANESE [JP,09-284200,A]

CLAIMS DETAILED DESCRIPTION TECHNICAL FIELD PRIOR ART EFFECT OF THE INVENTION TECHNICAL PROBLEM MEANS DESCRIPTION OF DRAWINGS DRAWINGS

[Translation done.]

JAPANESE [JP,09-284200,A]

CLAIMS DETAILED DESCRIPTION TECHNICAL FIELD PRIOR ART EFFECT OF THE INVENTION TECHNICAL PROBLEM MEANS DESCRIPTION OF DRAWINGS DRAWINGS

[Translation done.]

JAPANESE [JP,09-284200,A]

CLAIMS DETAILED DESCRIPTION TECHNICAL FIELD PRIOR ART EFFECT OF THE INVENTION TECHNICAL PROBLEM MEANS DESCRIPTION OF DRAWINGS DRAWINGS

[Translation done.]

JAPANESE [JP,09-284200,A]

CLAIMS DETAILED DESCRIPTION TECHNICAL FIELD PRIOR ART EFFECT OF THE INVENTION TECHNICAL PROBLEM MEANS DESCRIPTION OF DRAWINGS DRAWINGS

[Translation done.]

JAPANESE [JP,09-284200,A]

CLAIMS DETAILED DESCRIPTION TECHNICAL FIELD PRIOR ART EFFECT OF THE INVENTION TECHNICAL PROBLEM MEANS DESCRIPTION OF DRAWINGS DRAWINGS

[Translation done.]

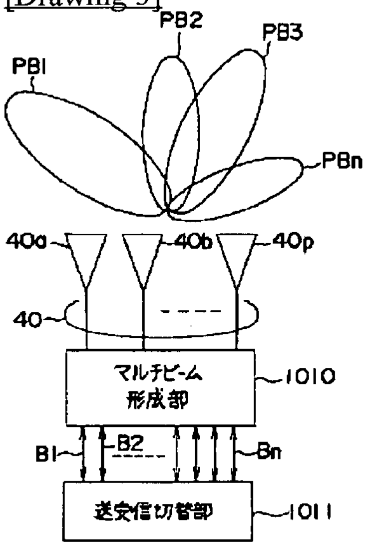
* NOTICES *

Japan Patent Office is not responsible for any damages caused by the use of this translation.

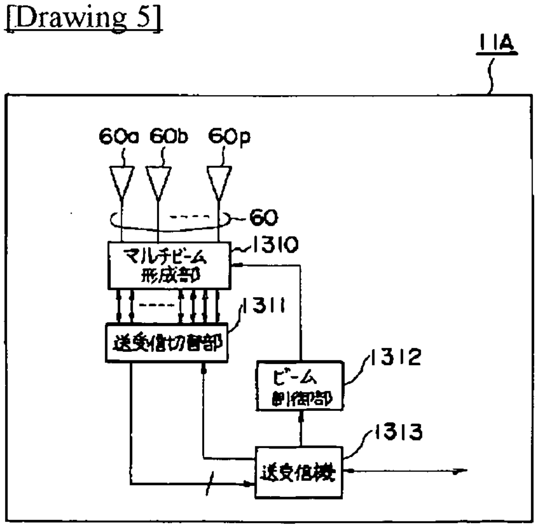
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

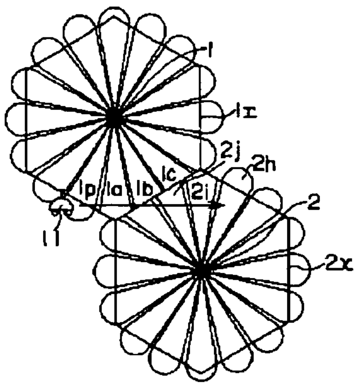
[Drawing 3]



[Drawing 5]

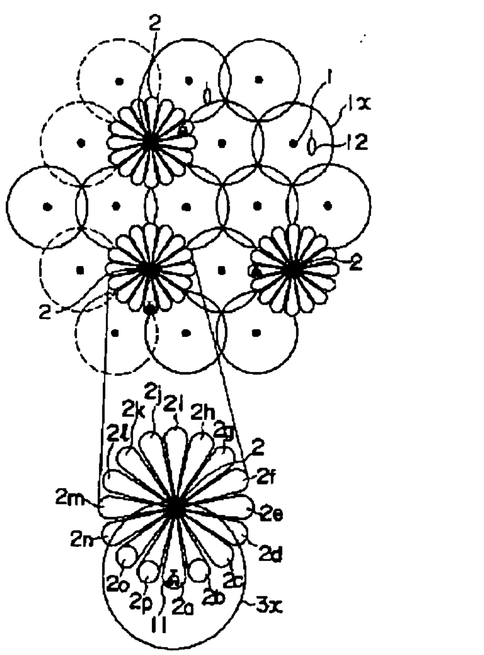


[Drawing 19]



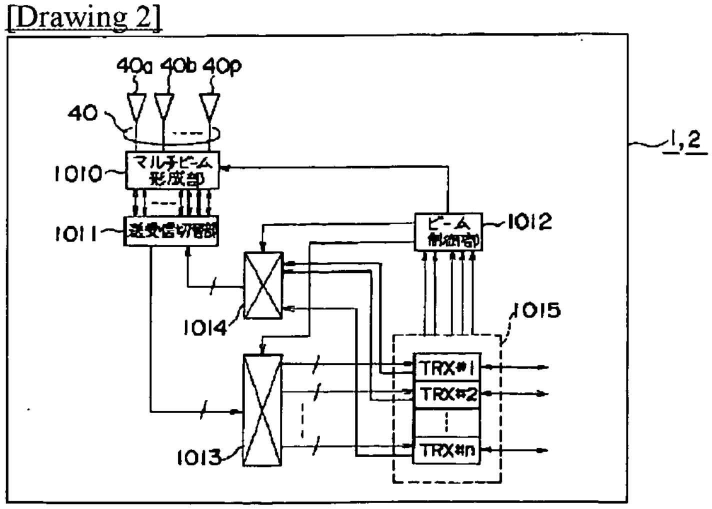
[Drawing 1]

(a)



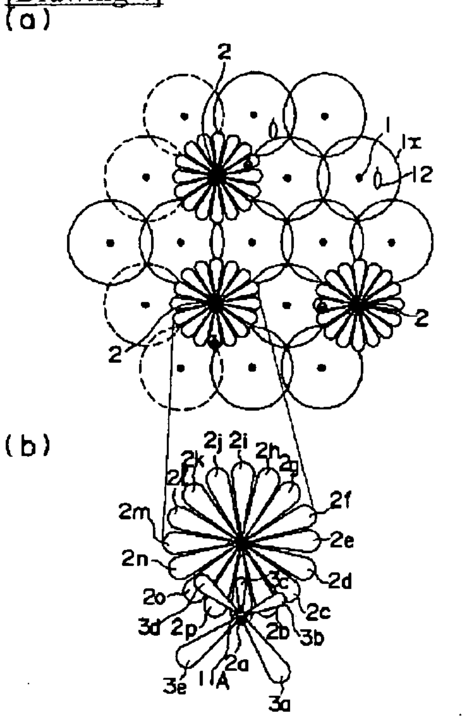
(b)

[Drawing 2]

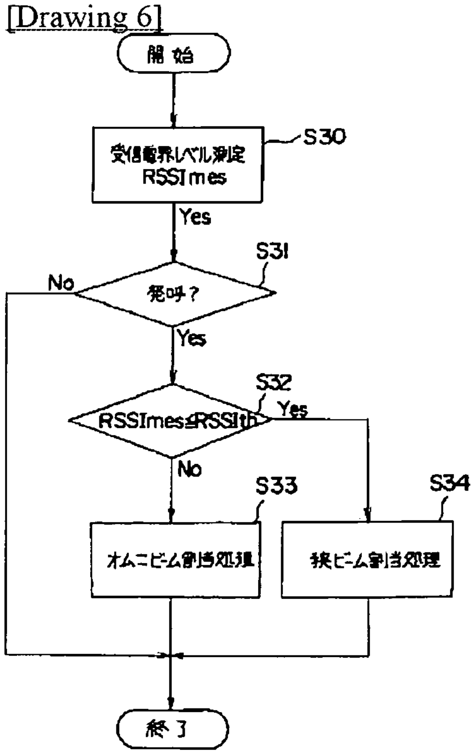


1013:受信スイッチマトリクス
1014:送信スイッチマトリクス
1015:送受信機ユニット

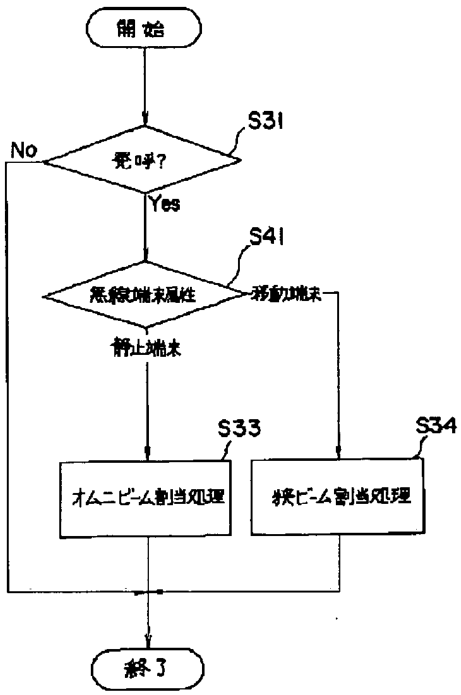
[Drawing 4]



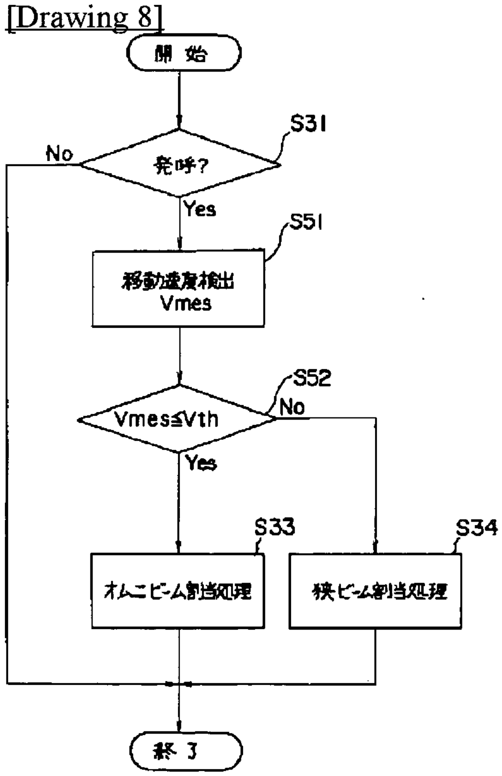
[Drawing 6]



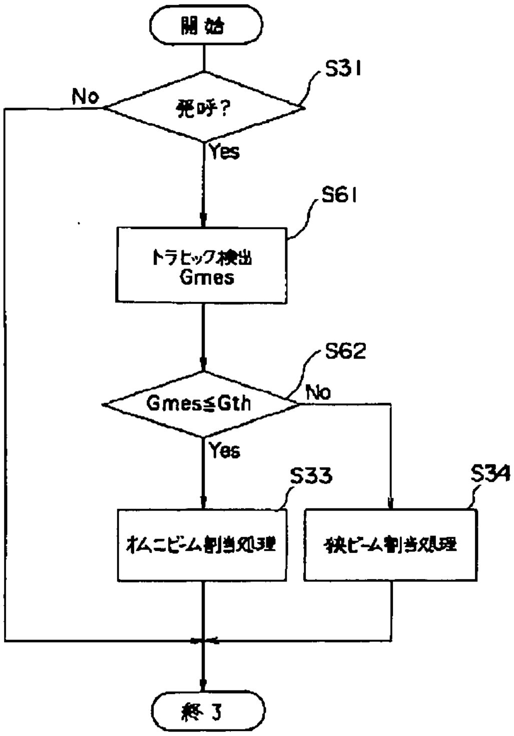
[Drawing 7]



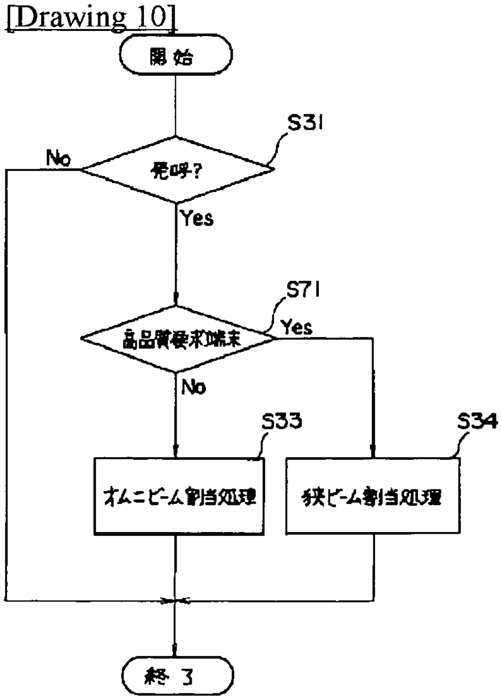
[Drawing 8]



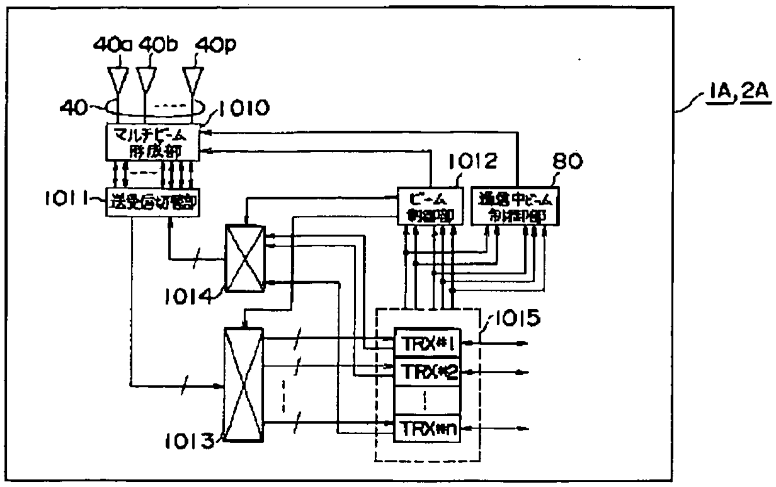
[Drawing 9]



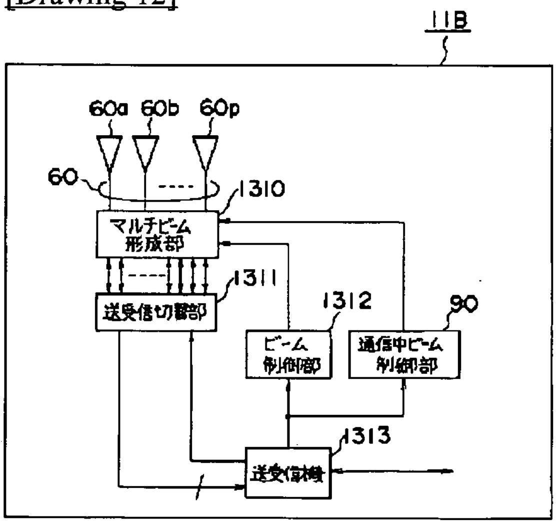
[Drawing 10]



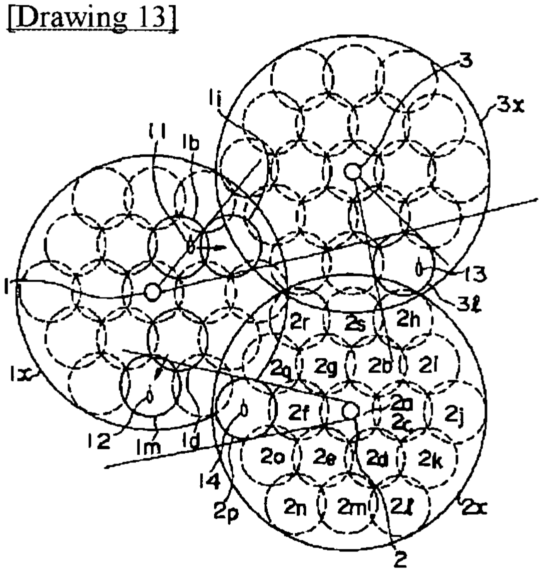
[Drawing 11]



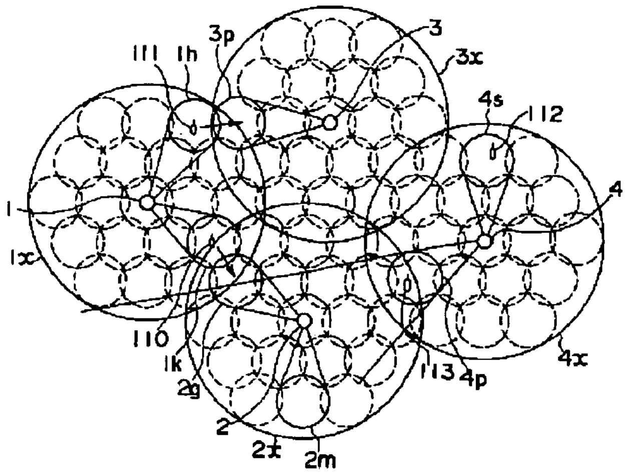
[Drawing 12]



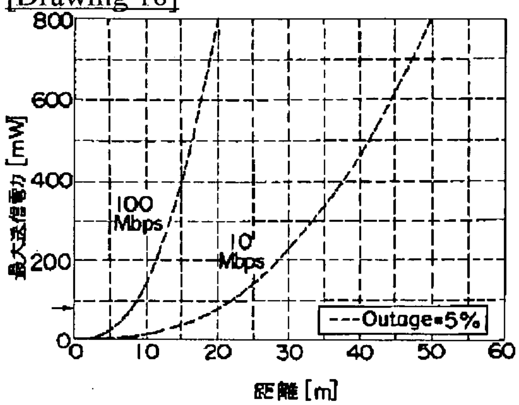
[Drawing 13]



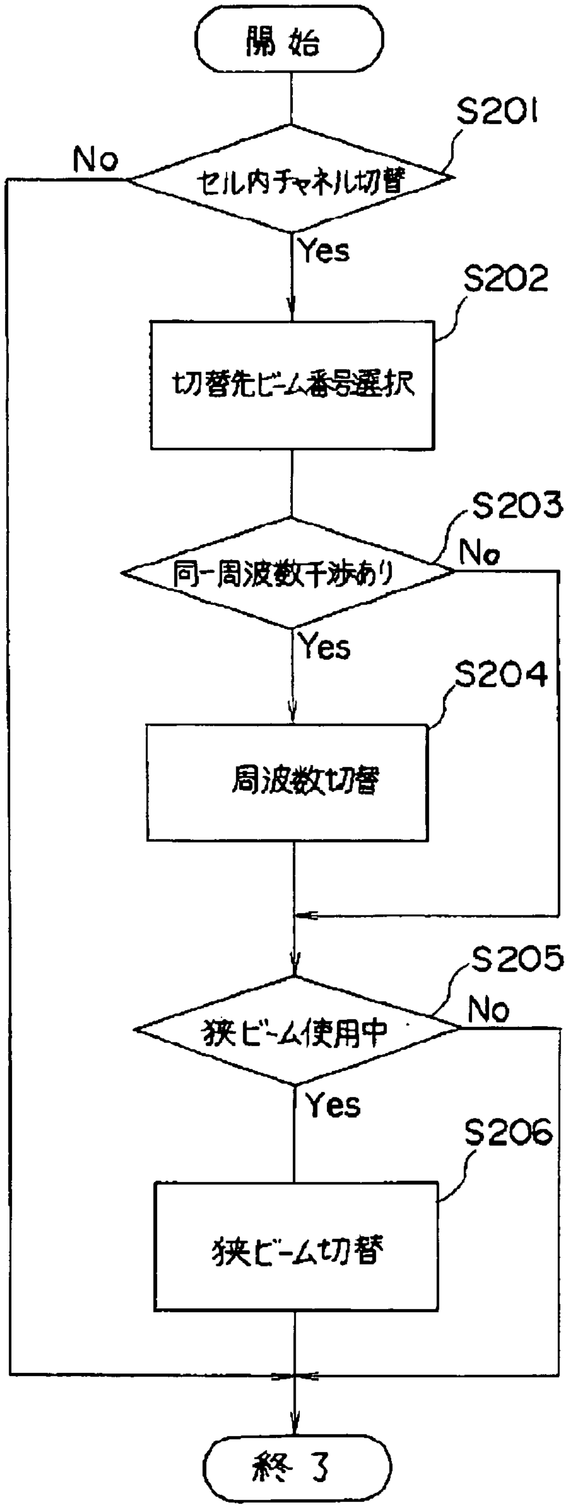
[Drawing 15]



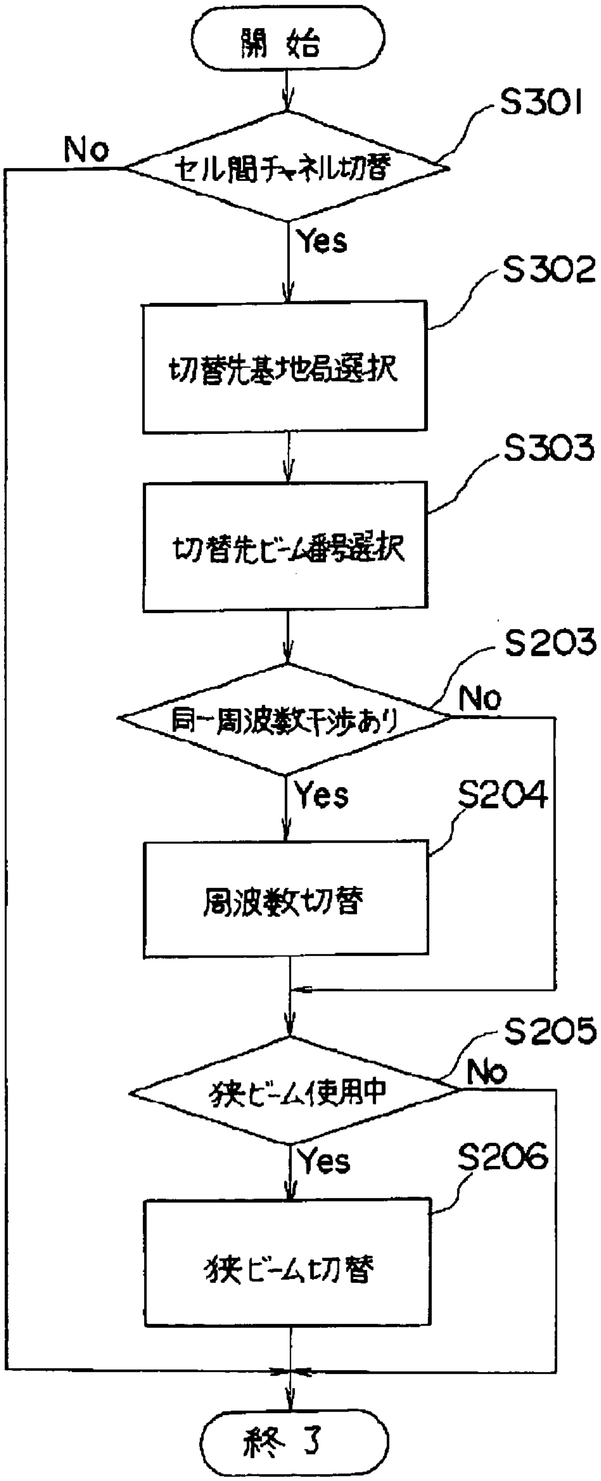
[Drawing 18]



[Drawing 14]

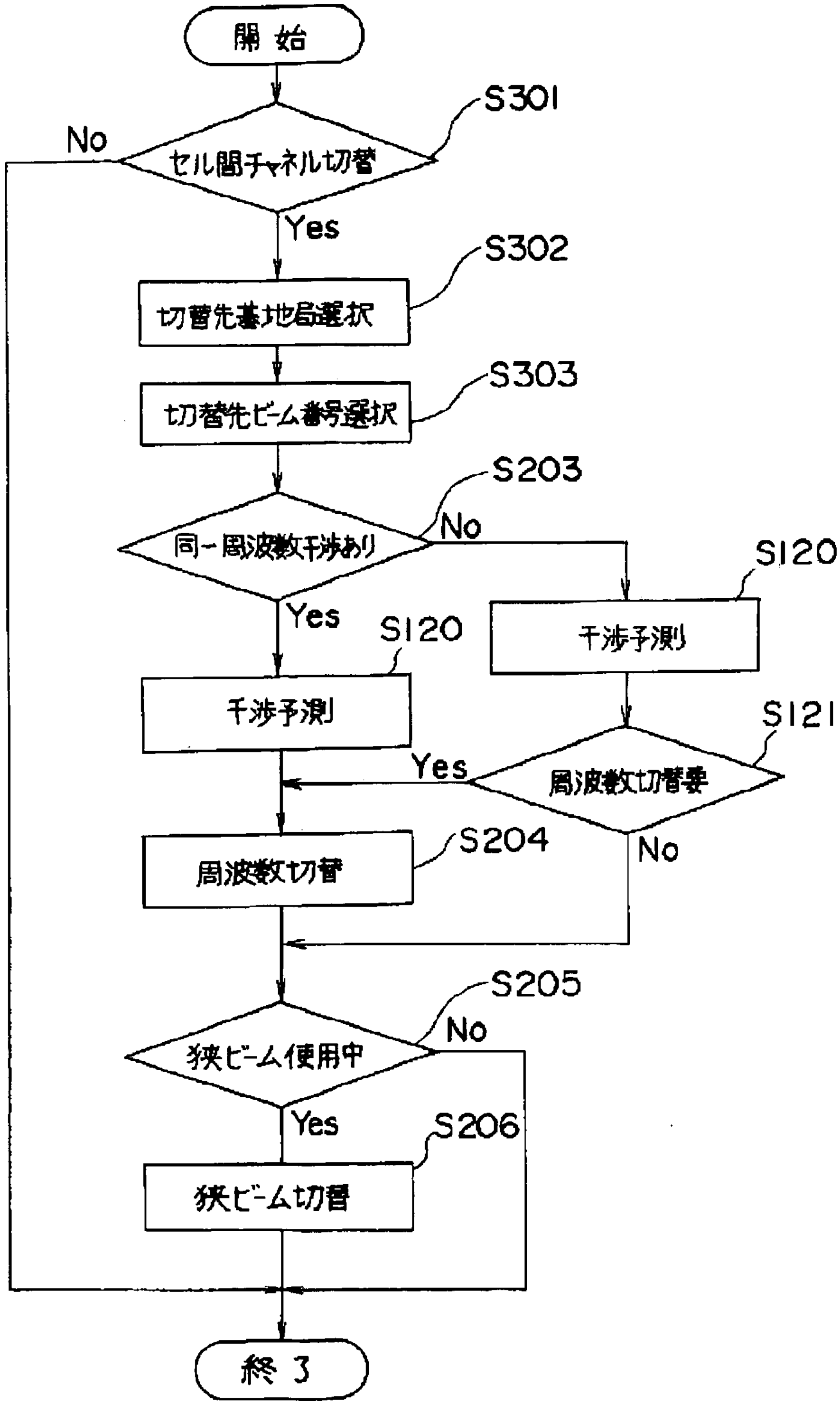

開始
S201
セル内チャネル切替
No
Yes
S202
切替先ビーム番号選択
S203
同一周波数干渉あり
No
Yes
S204
周波数切替
S205
狭ビーム使用中
No
Yes
S206
狭ビーム切替
終了

[Drawing 16]



[Drawing 17]

h g cg b eb cg e e



[Translation done.]

h g cg b eb cg e e